PHOSPHORUS CONTROL ACTION PLAN

and TMDL Report

WEBBER POND

Kennebec County

Webber Pond PCAP-TMDL Report
DEPLW 2002 - 0556

Maine Department of Environmental Protection

and the Maine Association of Conservation Districts

Public Review DRAFT
March 8 to April 7, 2003

WEBBER POND Phosphorus Control Action Plan

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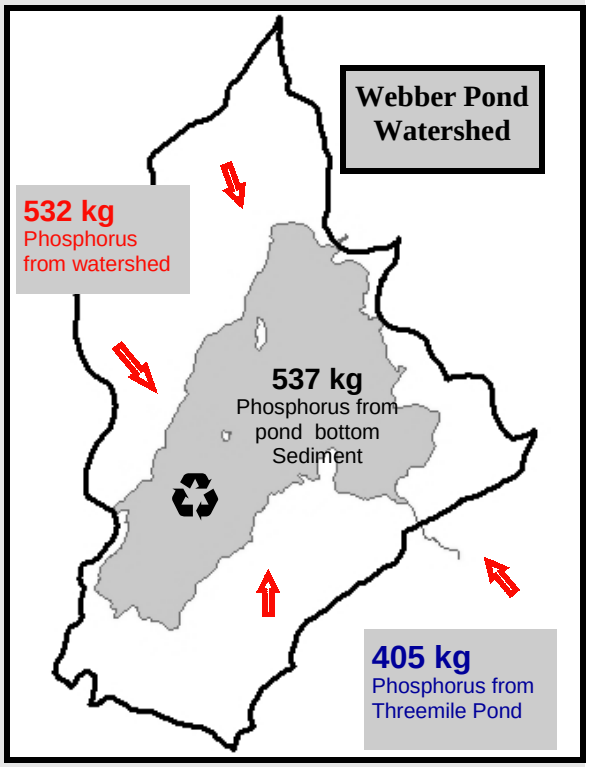
ACKNOWLEDGEMENTS

In addition to Maine DEP and US-EPA Region I staff, the following individuals, groups and agencies were instrumental in the preparation of this Webber Pond Phosphorus Control Action Plan-TMDL Report: MACD staff (Jodi Michaud Federle, Forrest Bell and Tim Bennett); China Region Lakes Alliance (Reb Manthey); Town of Vassalboro (Office staff); Kennebec County SWCD (Nate Sylvester and Dale Finseth); Webber Pond Association (Judy Moody and Frank Richards); Scott Pierz (former Vassalboro CEO); Maine Department of Marine Resources (Matthew O'Donnell and John Perry); Maine Department of Agriculture (David Rocque); Maine Forest Service (Morten Moesswilde); Maine Department of Inland Fisheries and Wildlife, Region B, Sidney (Jim Lucas); and special appreciation to Judy and Ike Moody (VLMP monitors) and Reb Manthey for the use of their boats to complete the TMDL-associated water quality monitoring during the 2002 season.

Webber Pond Phosphorus Control Action Plan
Summary Fact Sheet

Background

WEBBER POND is a 1,201 acre waterbody located in the Town of Vassalboro in Kennebec County, south central Maine. Webber Pond has a direct **watershed** (see map) area of about 8 square miles; a maximum depth of 41 feet, a mean depth of 16 feet; and a **flushing rate** of 1.5 times per year. The total Webber Pond watershed drainage area, inclusive of upstream situated Threemile and Threecornered pond subwatersheds, is 22.5 sq. mi.



Webber Pond has a history of supporting excessive amounts of algae in the late summer, due in large part to the presence and sediment accumulation of **phosphorus** that is prevalent in area soils. Soil erosion in the Webber Pond watershed can have far-reaching consequences. Soil particles transport the phosphorus, which essentially "fertilizes" the lake and decreases water clarity (see photo of Webber Pond below). Excess phosphorus can also harm fish habitat and lead to nuisance algae blooms—floating mats of green scum—or dead and dying algae. Studies have also shown that as water clarity decreases lakeshore property values also drop.

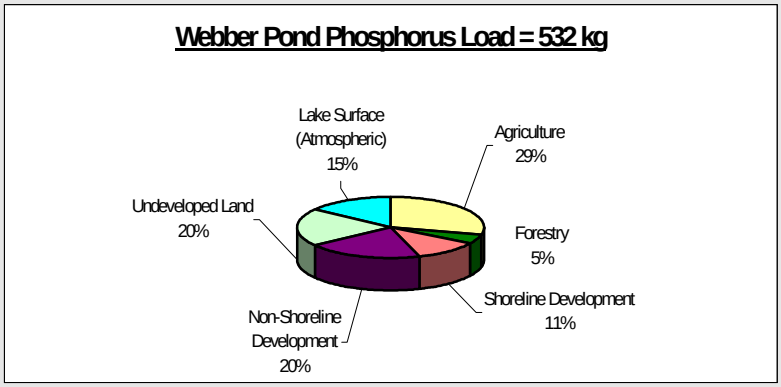
Stakeholder Involvement

With these issues in mind, federal, state, county, and local groups have been working together to address the water pollution problem. In 2001, the Maine Department of Environmental Protection funded a project in cooperation with the Maine Association of Conservation Districts, Kennebec County Soil and Water Conservation District, China Region Lakes Alliance, and the Webber Pond Association to identify and quantify the potential sources of phosphorus and identify the need for **Best Management Practices** to be installed in the watershed. A final report, completed in March of 2003, is entitled "Webber Pond Phosphorus Control Action Plan" and doubles as an official **TMDL** report that will be submitted to the U.S. Environmental Protection Agency, New England Region, for formal review and approval.

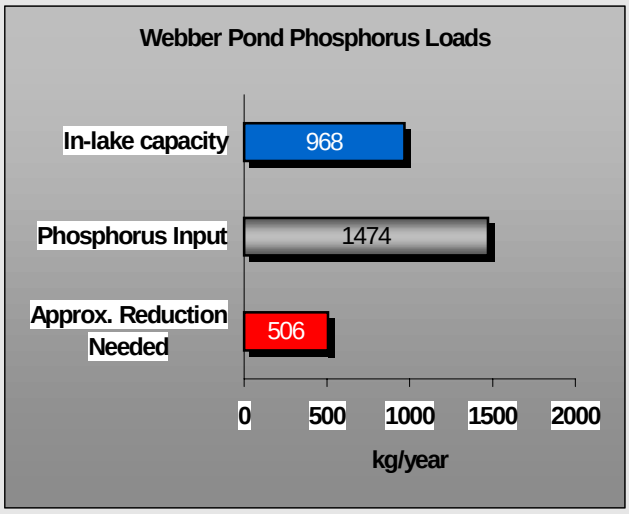
What We Learned

A land use assessment was conducted for the Webber Pond watershed to determine potential sources of phosphorus that may run off from land areas during storm events and springtime snow

melting. This assessment involved utilizing many resources, including generating and interpreting maps, inspecting aerial photos, and conducting field surveys. Similar assessments have been conducted for associated, upstream Threemile and Threecornered ponds, located in the neighboring towns of China and Augusta, as well as Vassalboro.



Land use assessment results estimate that 532 kilograms (kg) of phosphorus per year is exported to Webber Pond from the external direct watershed. The pie chart (top right) depicts the land use breakdown of the phosphorus load for developed land only. Results of an analysis of the indirect total phosphorus contribution from upstream Threemile Pond was estimated at 405 kg/yr. Over the past two decades the amount of phosphorus being recycled internally (537 kg/yr) from the bottom sediments of Webber Pond during the summertime has been fairly regular - exceeding over one-half of Webber Pond's natural capacity (968 kg TP/year) for in-lake phosphorus assimilation.



The graph (left) and map (previous page) displays the estimate that the internal (537 kg) + external (532 kg) + indirect (405 kg) = (1,474 kg) loading exceeds Webber Pond's capacity (968 kg) to effectively process phosphorus. The approximate amount needed to be reduced on an annual basis to ensure that Webber Pond is free of nuisance summertime algae blooms is 506 kg/yr.

What Can You Do To Help?

As a watershed resident or land user there are many things you can do to protect Webber Pond. Lakeshore owners can use phosphorus-free fertilizers and maintain natural vegetation adjacent to the lake. Agricultural and commercial land users can consult the Kennebec County Soil and Water Conservation District or Maine Department of Environmental Protection for information regarding Best Management Practices (BMPs) for reducing phosphorus. Watershed residents can become involved by volunteering to help the Webber Pond Association and participating in events sponsored by the CRLA. All stakeholders and watershed residents should attempt to learn more about their lake and the many resources available, including viewing the full version of the Webber Pond Phosphorus Control Action Plan. Copies of this report are available online at: http://www.state.me.us/dep/blwq/comment.htm or hard copies can be obtained at Maine DEP in Augusta.

Key Terms

- *A **watershed** is a drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.*
- *The **flushing rate** refers to how often the water in the entire lake water is replaced.*
- ***Phosphorus**: is one of the major nutrients needed for plant growth. It is naturally present in small amounts and limits the plant growth in lakes. Generally, as phosphorus increases, the amount of algae also increases.*
- ***Best Management Practices** are techniques to reduce sources of polluted runoff and their impacts. BMP's are low cost, common sense approaches to reduce storm runoff and velocity to keep soil out of lakes and tributaries.*
- ***TMDL** is an acronym for Total Maximum Daily Load which represents the total amount of a pollutant that a waterbody can withstand to meet water quality standards.*

Project Premise

This project, funded through a 319 grant from the United States Environmental Protection Agency (EPA) and the Maine Department of Environmental Protection (DEP), was directed and administered by the Maine Association of Conservation Districts (MACD) in partnership with Maine DEP from the summer of 2001 through the early spring of 2003.

The objectives of this project were twofold: First, a comprehensive land use inventory was undertaken to assist Maine DEP in developing an Phosphorus Control Action Plan (PCAP) and a Total Maximum Daily Load (TMDL) report for the Webber Pond watershed. Simply stated, a TMDL is the total amount of phosphorus that a lake can accept without harming water quality. The Maine DEP, with the assistance of the MACD Project Team and the Kennebec County Soil and Water Conservation District, will incorporate public comments before final submission to the US EPA. *(For more specific information on the TMDL process and results, refer to the appendices or contact Dave Halliwell at the Maine DEP Augusta Office at 287-7649 or at David. Halliwell@maine.gov*).

Secondly, watershed survey work, including a shoreline and septic survey evaluation, was conducted by the MACD project team to help assess ***Total phosphorus*** reduction techniques that would be beneficial for the Webber Pond watershed. Watershed survey work included assessing direct drainage ***nonpoint source (NPS) pollution*** sites that were not identified during the Webber Pond Watershed Nonpoint Source Pollution Survey conducted in 1997. The China Region Lakes Alliance (CRLA) — as part of its Watershed Management Plan (1998-2008) — intends to conduct a comprehensive follow-up watershed survey. The results of this assessment and some general recommendations for future conservation work in the watershed have been included to help citizens, organizations, and agencies restore and protect Webber Pond. In order to protect the confidentiality of landowners in the watershed, site-specific information has not been provided as part of this report.

Total Phosphorus (TP) - *is one of the major nutrients needed for plant growth. It is generally present in small amounts and limits the plant growth in lakes. Generally, as the amount of lake phosphorus increases, the amount of algae also increases.*

Nonpoint Source (NPS) Pollution *- is polluted runoff that originates from numerous, small sources as opposed to a direct (or point) source.*

This Phosphorus Control Action Plan project compiled and refined land use data that was derived from various sources, including the municipality of Vassalboro, the Webber Pond Association, the Kennebec County Soil & Water Conservation District (SWCD), and the CRLA. Local citizens, watershed organizations, and conservation agencies should benefit from this compilation of data as well as the watershed assessment and Best Management Practice (BMP) recommendations. Above all, this document is intended to help Threemile Pond stakeholder groups to effectively prioritize future BMP work in order to obtain the resources necessary for the implementation of NPS pollution mitigation work in the watershed.

Research Methodology

Webber Pond background information was obtained using several methods, including a review of previous studies of the lake and watershed area, numerous phone conversations and personal interviews with municipal officials, regional organizations and agencies, and several field tours of the watershed, including boat reconnaissance of the lake and shoreline.

Land use data were determined using several methods, including (1) ***Geographic Information System (GIS)*** map analysis, (2) analysis of topographic maps, (3) analysis of town property tax maps and tax data, (4) analysis of aerial photographs (US-FSA 1992 & 1997) and (5) field visits. Much of the undeveloped land use area (i.e., forest, wetland, grassland) was determined using GIS maps utilizing data from the Penobscot Bay Land Cover 1995/96 for the Coastal Change Analysis Program. The developed land use areas were obtained using the best possible information available through analysis of methods 2 to 5 listed above. Necessary adjustments to the GIS data were made using best professional judgment.

> ***GIS***—*or* ***geographic information system*** *combines layers of information about a place to give you a better understanding of that place. The information is often represented as computer generated maps.*

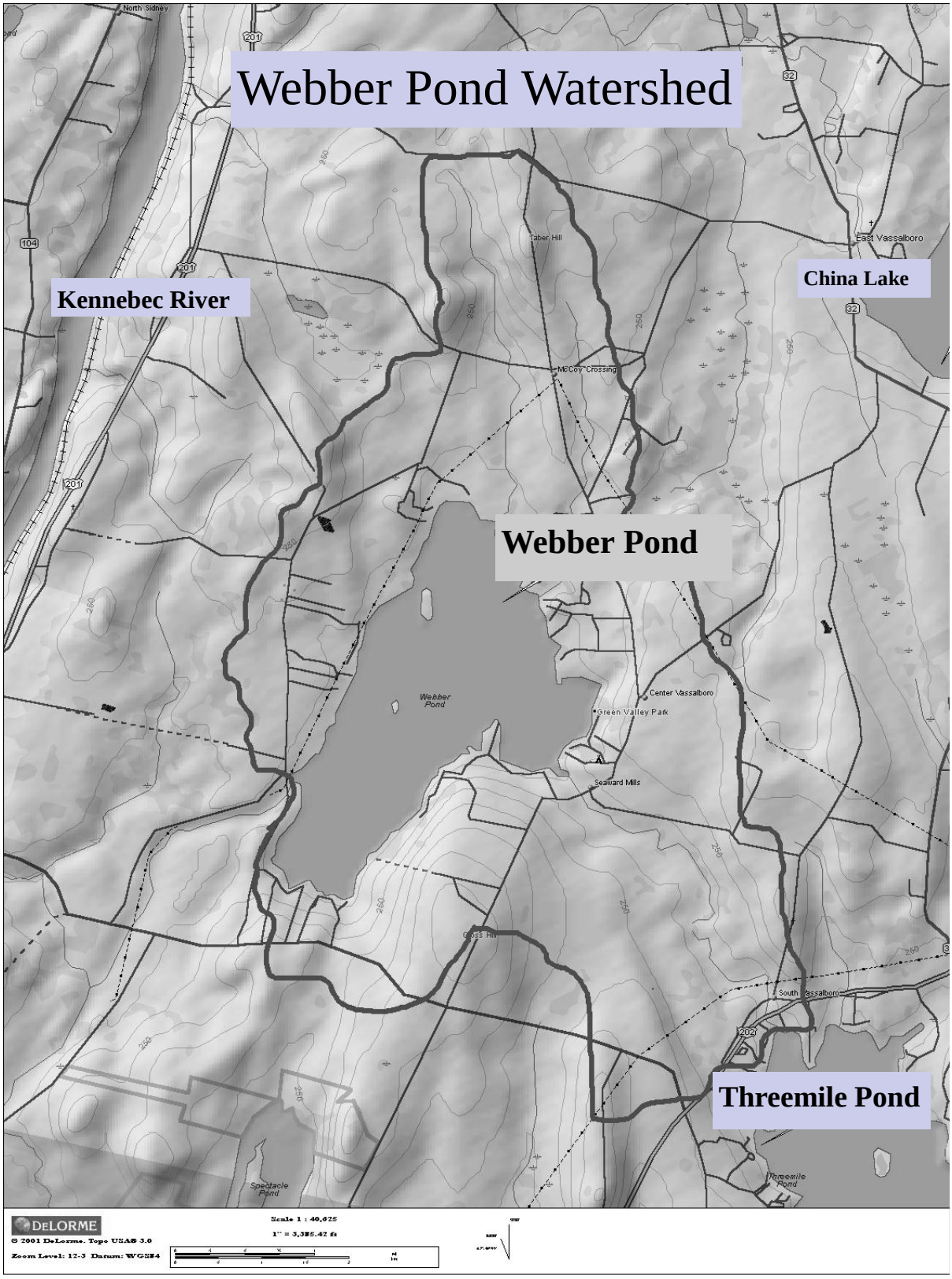
Roadway data were gathered by taking actual road width measurements of the various types of roads (state, town, private/camp) in the watershed. The roads were measured between the two outer edges of the roadside ditches or berms. An average width was used for each of the three road types. Final measurements for all roadways within the watershed were extrapolated using GIS (Penobscot Bay Land Cover 1995/96 Analysis for the Coastal Change Analysis Program), and USGS topographical maps. Finally, the roadway area was determined using linear distances and average widths for each of the three main road types . Additional land use data (i.e. residential, institutional) were determined using GIS, aerial photos, topographic and property tax maps as well as personal consultation and, when necessary, field visits.

Agricultural information within the Webber Pond watershed was provided by the Kennebec County Soil & Water Conservation District (SWCD). Information regarding forestry harvesting operations was provided by the Maine Forest Service, Department of Conservation.

Limitations of Study

Land use data gathered for the Webber Pond watershed is as accurate as possible given available information and resources utilized. However, the final numbers for the land use analysis and phosphorus loading graphics are approximate at best and should be viewed as carefully researched estimations only.

Figure 1: Map of Webber Pond direct watershed



WEBBER POND Phosphorus Control Action Plan

DESCRIPTION of WATERBODY and WATERSHED

WEBBER POND is a 1,201 acre single-basin waterbody located in the Town of Vassalboro (DeLorme Atlas, Map 13), within Kennebec County in south central Maine. Webber Pond has a **direct watershed** area (see Figure 1) of 6,371 acres (8.1 square miles), and is within the Sevenmile Stream drainage of the Lower Kennebec River watershed. Webber Pond has a maximum depth of 12 meters (41 feet), an overall mean depth of 5 meters (16 feet) and has a flushing rate of 1.5 times/year. The total Webber Pond watershed drainage area, including the Threemile and Threecornered pond subwatersheds, is 14,226 acres (22.5 mi^2).

*The **direct watershed** refers to the land area that drains to the lake without first passing through another lake or pond.*

Drainage System – The entire Webber Pond watershed includes a chain of three larger (1,201 acre Webber, 1,132 acre Threemile, and 180 acre Threecornered) and two lesser ponds (Anderson and Mud). Threecornered Pond (to the south) drains into Threemile Pond (to the southeast), which drains directly into Webber Pond via Seaward Mills Brook. Webber Pond has a single outlet at the dam - Sevenmile Stream, a tributary to the Kennebec River. A number of streams drain into Webber Pond, including Seaward Mills Brook which is the inlet from Threemile Pond and by far the largest tributary, contributing approximately 90% of the total tributary water input to Webber Pond (Maine DEP 1981).

Water Quality Information

Webber Pond is listed on the Maine Department of Environmental Protection's 303(d) list of lakes that do not meet State water quality standards as well as the State's Nonpoint Source Priority Watersheds list. Hence, an Action Plan for Phosphorus Control (and TMDL) was completed in the Winter of 2003.

***Secchi Disk Transparency**—a measure of the transparency of water (the ability of light to penetrate water) obtained by lowering a black and white disk into water until it is no longer*

Water quality data for Webber Pond has been collected through the Maine DEP VLMP since 1975. Based on **Secchi disk transparencies** and measures of total phosphorus and **chlorophyll-a**, the water quality of Webber Pond is considered to be poor and the potential for nuisance summertime algae blooms is moderate to high. Together these data document a trend of increasing **trophic state** and hence a violation of the Class GPA criteria requiring a stable or decreasing trophic state.

***Chlorophyll-a** is a measurement of the green pigment found in all plants including microscopic plants such as algae. It is used as an estimate of algal bio-mass—the higher the Chl-a number, the higher the amount of*

***Trophic state—**the degree of eutrophication of a lake. Transparency, chlorophyll a levels, phosphorus concentrations, amount of macrophytes, and quantity of dissolved oxygen in the hypolimnion can be used to assess tropic state.*

Nonpoint source (overland) pollution is the main reason for declining water quality in Webber Pond. NPS is polluted runoff. During and after storm events, nutrients such as phosphorus—

naturally found in Maine soils– drain into the lake from the surrounding watershed by way of streams and overland flow.

Phosphorus can be thought of as a fertilizer—a primary food for plants, including algae. Phosphorus is naturally limited in lakes. When lakes receive excess phosphorus from NPS, it "fertilizes" the lake by feeding the algae. Too much phosphorus can result in algae blooms, which can damage the ecology/aesthetics of a lake, as well as the economic well-being of the entire community.

Principle Uses: The dominant human uses of the Webber Pond shoreline are residential (both seasonal and year-round occupancy) and recreational—boating, fishing and swimming/beach use. There is public access to the lake at the Town of Vassalboro boat launch and swim area, located off of the Webber Pond Road at the southwest corner of the lake. There is one public campground located on the eastern shore of the lake.

Human Development: Webber Pond is a moderately developed lake with approximately 40 to 50 percent of the shoreline developed (MACD & CRLA 2001). There are 162 shoreline dwellings, of which an estimated 77% are seasonal cottages (125) and 23% are year-round homes (37). There are approximately 1 to 2 seasonal-to-year-round conversions per year (Vassalboro planning board meeting minutes, 1997-2000).

The entire Webber Pond direct watershed is located within the Town of Vassalboro, encompassing approximately 21% of the Town of Vassalboro (KC-SWCD). Vassalboro is a rural, residential suburb, located five miles north of Augusta and 15 miles south of Waterville in central Kennebec County. Augusta and Waterville are the major commercial and employment centers in this area.

Over a decade ago, Maine DEP found that increased development in the watershed had increased phosphorus loading to the lake and that loading will "grow substantially over the next decade as moderate development pressure continues to convert forest and farmland to new dwelling lots and as seasonal cottages are converted to year-round use" (Maine DEP 1991). Over the past two decades, the amount of forested land has decreased by at least 10% while the amount of developed land has increased (Maine DEP 1981, MACD 2001).

*181 lakes were listed on the **Nonpoint Source Priority Watersheds** list released by the Maine Department of Environmental Protection in 1998. Webber Pond was listed among 41 lake watersheds as the "highest priority". This list and the evaluation process used to determine the list are available on the Maine DEP website: www.state.me.us/dep/blwq/docwatershed/prilist5*

Webber Pond is on the State's **Nonpoint Source Priority Watersheds** list due to algal blooms and other factors. In addition to NPS pollution, high growth rates are a concern for the watershed. There are 4,047 people currently residing in Vassalboro, a 10% increase for the 1990s (US Census 2000). Prior decades reveal an 8% increase for the 1980s and a 30% increase for the 1970s (US Census). The estimated watershed population is 950 (Vassalboro tax records; US Census 2000).

Water Level (Dam) Management - The outlet dam is owned, operated and maintained by the Webber Pond Association. The dam was reconstructed in 1993 to facilitate limited enhanced annual drawdowns. One objective of the annual drawdown is to "provide for adequate and timely flushing of surface water which is high in phosphorus and algal matter to aid in water quality restoration" (Maine DEP 1996). The dam has only 5.5 feet of drawdown potential; however, hydraulic forces prevent removal of the bottom boards (Frank Richards, WPA, personal communication).

In general, there has been a 3 to 4-foot draw right after Labor Day for about the past 10 years (1993-2002) (Frank Richards, WPA, personal communication). In recent years, the timing of the drawdown is determined at the Webber Pond Association's annual meeting and the exact dates of drawdown vary from year to year. In 2001, all boards were pulled immediately after Labor Day. In 2002, one dam board (one on each side) was removed on August 13 for a 6-inch draw in an effort to flush out the top algae-laden layer of water. A second 8-inch draw was removed on September 2 and a third draw of about 8 inches on September 8, with as many remaining boards as possible being pulled after September 15th (Frank Richards, WPA, personal communication).

Historically, few boards were replaced and much of the lake bottom was left exposed during the winter months. In recent years, some boards are replaced in October to allow the lake water level to rise before ice-in, with the remainder of boards replaced sometime in the spring, which allows for about 2 feet of draw to be left exposed at the control gate during the winter months (Frank Richards, WPA, personal communication).

Webber Pond Outlet Dam during draw-down—September, 2001

Fish Assemblage, Alewife History, and Anadromous Fish Restoration

Based on records provided by the Maine Department of Inland Fisheries and Wildlife (Maine DIFW) and a recent telephone conversation with fish biologist Jim Lucas (Region B, Sidney DIFW office), **Webber Pond** (Town of Vassalboro, Seven Mile Stream and Kennebec River drainage) is currently managed as a mixed warmwater and coldwater fishery and was last surveyed in 1993 (Maine RE-MAP Project). A total of **14** fish species are listed, including: **9** native indigenous fishes (American eel, Fallfish, White sucker, Brown bullhead, Chain pickerel, Banded killifish, Redbreast sunfish, Pumpkinseed, and Yellow perch); **3** introduced fishes of uncertain origin (White perch, Smallmouth bass and Largemouth bass); and **2** annually stocked managed fishes (sea-run Alewife - Maine DMF **anadromous** fish restoration program, and catchable-sized Brown trout - Maine DIFW). Golden shiner are not listed, but probably have been introduced as a commonly used bait fish. According to Maine DIFW, Webber Pond has been targeted for a new '**put-and-take-only**' Brook trout fishery program and will receive its first stocking in the spring of 2004. Similar to neighboring Threecornered Pond (1998), there have been recent (June 2002) unverified records of larger illegally introduced Northern pike being angled from Webber Pond. Kennebec River stray Sea lampreys have been historically reported from Webber Pond, as well as from the upstream situated Threemile Pond (Maine DIFW).

Anadromous *fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn.*

Put-and-take-only *is the process of stocking game fish that are intended to be harvested in a short period of time.*

The Maine Department of Marine Resources (Maine DMR) has been stocking Webber Pond with Alewives since 1997 as part of the Lower Kennebec River Anadromous Fish Restoration Plan (1986). This plan seeks to restore Shad and Alewife to their historical habitat in the Kennebec River above Augusta (Maine DMR 1986). Stocking in Webber Pond was deferred in 1986 at the request of Maine DEP to establish a long-term water quality database for this lake. In 1987, Maine DMR, DEP and IFW began a 10-year cooperative study of the relationship between anadromous Alewives, resident freshwater species and the water quality of selected study lakes (Kircheis et al. 2002). This study suggested that study lakes were not noticeably affected by Alewife stocking at 6 fish/acre (Maine DEP 1995). Table 1 (below) outlines the extent of alewife stocking in Webber Pond by Maine DMR.

Table 1. *History of Alewife Stocking in Webber Pond*

YEAR	# ALEWIVES STOCKED	FISH/ACRE
1997	2,504	2
1998	5,008	4
1999	7,512	6
2000	7,512	6
2001	7,512	6
2002	7,619	approx. 6
TOTAL	**37,667**	

The stocking rate for Webber Pond will remain at 6 fish/acre until a proposed fishway is installed, at which time the rate will be increased to the full stocking rate of 35 fish/acre or 43,820 Alewives (Matthew O'Donnell, formerly of Maine DMR, personal communication). Plans for fishway installation that would allow for fish passage from the Kennebec River to Sevenmile Stream and into Webber Pond have yet to be finalized (Matthew O'Donnell, formerly Maine DMR, personal communication). Webber Pond usually has sufficient water levels to allow for fish passage from the lake over the spillway into Sevenmile Stream throughout the low-water summer season.

Improved water transparencies and overall acceptable water quality conditions in Webber Pond, including restoration of suitable **dissolved oxygen** conditions (greater than 5 parts per million) will serve to enhance and/or support the continued maintenance of both existing warmwater and marginally coldwater fisheries.

Dissolved Oxygen*—refers to the amount of oxygen measured in the water. It is used by aquatic organisms for respiration. The higher the temperature, the less oxygen the water can hold. Oxygen will naturally decline during the summer months as water temperatures*

Watershed Soils (Source: USDA SCS, 1978): Soils dominating the Webber Pond drainage area are fine to medium textured and are easily erodible when vegetation is removed (CRLA 1999) and are described by the following three soil associations:

1. Hollis-Paxton-Charlton-Woodbridge Association (82%). Shallow and deep, somewhat excessively drained to moderately well-drained, gently sloping to moderately steep, moderately coarse textured soils, on hills and ridges.

2. Buxton-Scio-Scantic Association (12%). Deep, moderately well-drained to poorly drained, nearly level to sloping, medium textured soils, in flat areas near waterways.

3. Scantic-Ridgebury-Buxton Association (6%). Deep, poorly drained to moderately well-drained nearly level to sloping, medium textured soils in valleys and moderately coarse textured soil in flat areas or depressions on upland ridges.

Land Use Inventory

The results of the Webber Pond watershed land use inventory are depicted in Table 2. The various land uses are categorized by developed land vs. undeveloped land. The developed land area comprises approximately 20% of the watershed and the undeveloped land with the surface area of Webber Pond comprise the remaining 80% of the watershed. These numbers may be used to help make future planning and conservation decisions relating to the Webber Pond Watershed. The information in this table (following page) was also used as a basis for preparing the Total Maximum Daily Load report (see Appendices).

Descriptive Land Use and Phosphorus Export Estimates

Agriculture: In 1981, Maine DEP conducted a Diagnostic Feasibility Study for the entire Webber Pond watershed, inclusive of both the Threemile and Threecornered Pond watersheds. In this study, high external-watershed TP loading was attributed to poor manure handling techniques (winter spreading on grassland) and inappropriate nutrient management. In 1983, a watershed management plan, including a comprehensive listing of recommended agricultural conservation practices for Webber, Threemile and Threecornered Pond watersheds, was developed by the

Table 2: *Land Use Inventory for the Webber Pond Watershed*

LAND USE	Total Area Acres	Tot Land Area %	TP Exp Avg %
Agricultural and Forestry practices			
Cropland	121	1.9%	13.8%
Hayland	175	2.7%	8.7%
Low-Intensity Hayland	149	2.3%	2.3%
Orchard	10	0.2%	0.3%
Pasture/Barnyard	60	1.0%	3.4%
Operated Forestland	170	2.7%	5.2%
Sub-totals	**687**	**11%**	**34%**
Shoreline development			
Low impact residential	28	0.4%	0.5%
Medium impact residential	44	0.7%	1.7%
High impact residential	10	0.1%	0.5%
Septic Systems			2.3%
Camp & Private Roads	30	0.5%	4.6%
Recreational	49	0.8%	1.9%
Sub-totals	**161**	**3%**	**11%**
Non-shoreline development			
State Roads	2	0.0%	0.2%
Town Roads	51	0.8%	5.8%
Low Density Residential	254	4.0%	4.8%
Commercial	4	0.1%	0.5%
Institutional	25	0.4%	2.9%
Golf Course - tees and greens	3	0.0%	0.9%
Golf Course - fairways	12	0.2%	0.6%
Golf Course - other areas	86	1.3%	4.6%
Sub-totals	**436**	**7%**	**20%**
Total Ag/Forestry/Development	**1,283**	**20%**	**65%**
Inactive/Passively Managed Forest	3035	47.6%	9.2%
Wetlands	208	3.3%	3.2%
Scrub Shrub	355	5.6%	2.7%
Reverting Fields	285	4.5%	4.3%
Bare Land	4	0.1%	0.3%
Undeveloped	**3,887**	**61%**	**20%**
Total Open Water	**1,201**	**19%**	**15%**
TOTAL DIRECT WATERSHED	**6,371**	**100%**	**100%**

Kennebec County Soil and Water Conservation District (SWCD) and the USDA Natural Resources Conservation Service (NRCS).

As a result of the extensive amount of conservation measures employed, in addition to less intensive farming practices and changes in land use patterns, a significant reduction in external loading from agricultural sources was suggested with probable 50% reductions of phosphorus loading to Webber Pond (Maine DEP 1991).

During the last decade (1991 to 2001), there have been fewer agricultural conservation practices installed by the Kennebec County NRCS office, with the exception of the development of nutrient management plans for two farms in the watershed covering an estimated 150 acres of farmland (KC NRCS).

More recent agricultural data were provided by the Kennebec County SWCD and confirmed by aerial photo analysis (1992 and 1997) and field verified with the assistance of Kennebec County SWCD staff.

The agricultural land area of the Webber Pond drainage area currently comprises 8% of the total watershed area and an estimated 29% of the external phosphorus load.

Forestry: Generally, poorly managed forestry operations have the potential to negatively impact a waterbody by erosion and sedimentation from logging sites. Local foresters within the Webber Pond watershed have worked with the CRLA to minimize potential impacts and many are Certified Logging Professionals trained to reduce potential environmental impacts associated with forest practices (CRLA 1999).

Maine landowners who harvest more than 2 acres of forest (or 5 acres if partially cut) are required to submit a Forest Operations Notification, including a location map, to the Maine Forest Service, Department of Conservation. After harvest, a Landowner Report of acres actually harvested in a given year is required. These reports provide a reasonable average annual estimate of those acres where some type of partial timber harvesting took place. The estimated “operated forest” acres for Webber Pond, based on Landowner reports submitted for 1998 – 2001 average 170 acres per year, accounting for 2.4% of the watershed area. Landowner Reports also indicate if any clearcutting took place, and none was reported for this time period.

Harvested forest acres in Maine typically regenerate as forest, whether or not they are under any type of planned forest management or under the supervision of a Licensed Forester. Forest areas without harvesting may be managed passively, or may be under an active management program with no commercial activity occurring in 1998-2001. Landowner Reports also reflect forest acres that which have been cleared with the intention of converting the land to another use, such as cropland, pasture, or residential use. There were a total of 2 acres of “forest conversion” reported during this four-year time period (All forestry data provided by Morten Moesswilde, Maine Forest Service). The operated forestland area within the watershed approximates 2.7% of the total

land area and an estimated 5.2% of the total phosphorus load to Webber Pond.

Shoreline Residential Lots (Houses and Camps): A shoreline survey was completed in August of 2001 by Maine DEP and MACD project staff. The survey was conducted from a boat, approximately 50' from the shoreline. The survey results provide a shoreline structure tally as well as subjective determinations of the impact of each lot in regard to phosphorus loading. There are an estimated 162 homes and cottages on Webber Pond comprised of 77% seasonal (125) and 23% year-round (37) dwellings.

To determine phosphorus loading estimates, each developed shoreline lot was assigned an NPS pollution impact rating using best professional judgment. The ratings range from 1 to 5, with 1 being very low impact (natural - best case scenario) and 5 being high impact (unnatural – worst case scenario). Table 3 (below) outlines the impact ratings assigned to each shoreline lot during the survey. Lots receiving a rating of 1 have a full naturally vegetated buffer. Conversely, a lot given a score of 5 would have little or no vegetative buffer and support bare (eroding) soil – a visible source of phosphorus input to the lake. A grass covered mowed lawn leading down to a rip-rapped shoreline or beach would receive a rating of 4 – but, only if there was no evidence of bare soil, in which case a rating of 5 would be assigned.

TABLE 3. ***Shoreline Survey Results.***

NPS Pollution Potential Severity Score	Impact rating characterized by one or more of the following:	Number of shoreline sites identified within each category	% of sites within each category
1 = very low impact	All natural vegetation—great buffer; good setback from lake	47	29%
2 = low impact	Good natural vegetation; good setback from lake	9	5%
3 = moderate impact	Lack of adequate buffer; close to lake	87	54%
4 = moderately high impact	Lack of buffer; steep slopes; close to lake	11	7%
5 = high impact	Lack of buffer; steep slopes; close to lake; bare soils	8	5%

Overall, 66% of the developed shoreline lots on Webber Pond have a moderate to high impact due to inadequate or nonexistent vegetative buffers and/or close proximity to the lake. Many of the shoreline areas have been adequately rip-rapped at the toe of the slopes, but lack vegetative plantings (other than mowed lawns) above the rip-rapped areas. Vegetative buffers help to decrease the amount and flow of run-off from the site. Many of the homes and cottages have mowed grass lawns that stretch down to the lake and do not serve as adequate buffers.

To estimate phosphorus loading from residential land use, the shoreline survey data were condensed into three categories - low, medium and high impact. Phosphorus loading coefficients were developed using information on residential lot stormwater export of algal available phosphorus (Dennis et al. 1992). Seasonal and year-round camp and home lots on Webber Pond comprise 1.2% of the land area and an average of 14 kg of total phosphorus annually, which approximates 2.7% of the estimated total phosphorus load.

- *To convert kg of total phosphorus to pounds—multiply by 2.2046*
- *To convert kg/hectare to lbs/acre—multiply by .892*

Septic Systems: Currently, there are no public sewer services for the land areas within the Webber Pond watershed. Vassalboro's Shoreland Zoning Ordinance has a provision for septic waste disposal requiring that by December 31, 1995, all landowners within the Shoreland Zone provide documentation of system installation in compliance with Maine's Subsurface Wastewater Disposal Rules, or install a new system in accordance with this rule. Failure to comply constitutes a violation and is subject to enforcement action. As a result of this shoreland zoning ordinance, many old septic systems were replaced for an estimated 95% compliance rate (CRLA 1999; S. Pierz, personal communication, 2001).

In order to estimate total phosphorus loading from shoreline septic systems, a simple model was used based on the following attributes: seasonal or year-round occupancy; estimated age of the system; estimated distance of the system to the lake; and an estimated 3 people per dwelling. These attribute values were determined by shoreline survey, town records and personal interviews with Town of Vassalboro officials.

Estimates of the loading from residential septic systems on Webber Pond range from a low of 10 to a high of 30 kg total phosphorus per year. Estimates of the phosphorus loading from the single commercial campground septic system ranged from a low of 2 to a high of 5 kg total phosphorus per year. Combined residential and commercial shoreline septic system loading approximates an average total watershed phosphorus export of 2.3% or 12 kg TP annually.

Recreational (Shoreline): Included in this category are the public boat launch/swim area (approximately 1 acre) and the commercial campground located on the eastern shore of Webber Pond. The campground facility has 84 campsites – (9 tent sites and 75 RV sites). Campground use is characterized by recreational vehicles/campers that remain on site throughout the summer season (Reb Manthey, personal communication). Forty-five of the RV sites (60%) have sewer hook-up capability. The campground covers a total of 78 acres, of which approximately 30 acres

are in Tree Growth (Vassalboro Tax Assessor). There is an office, store/laundry room and game room, a swimming area, volleyball-basketball court and playground area. There is also a small marina operation with boat docking, boat rentals (canoes, paddleboats and small outboards) and a gas pump. Estimates of loading from recreational (shoreline) development approximates an average TP export of 1.9% or 10 kg of TP annually.

Shoreline Erosion: Undeveloped areas of the lake shoreline that may be eroding due to natural causes (i.e., wind, wave and ice action) are not included as a source of phosphorus due to the difficulty in quantifying impact area and assigning suitable coefficients. Areas of concern regarding shoreline erosion include Town Farm Island and areas at the northern end of the lake. The CRLA assessed these areas in August of 2002 for potential NPS-BMP implementation to be performed by the CRLA Conservation Corps during the 2003 field season (Reb Manthey, personal communication 2002).

Private/Camp Roadways: There are 19 private camp roads around Webber Pond comprising 8 miles (CLRA). As of December 2001, there were five formal Road Associations for the private camp roads on Webber Pond (Judy Moody, personal communication). Total phosphorus loading from private camp roads comprises only 0.5% of the land area and approximates 4.6% of the total watershed TP export annually.

Overall, shoreline development comprises only 3% of the total watershed area however it contributes an average of 61 kg of total phosphorus annually which approximates 11% of the estimated phosphorus load.

Other Development and Land Uses

These areas consist of lands such as state and town roadways, low-density non-shoreline residential areas and other land uses such as institutional (public) areas, commercial and recreational areas. These land use areas were calculated using GIS land use coverage provided by the Kennebec County Soil and Water Conservation District, as well as tax data, aerial photos and field visits (ground-truthing).

Non-Shoreline Development - All lands outside the immediate shoreline area of Webber Pond, including residential areas, commercial, institutional (public) areas and the public golf course constitute non-shoreline development.

Roadways: There is less than 1 mile of state roadway and almost 11 miles of town roads within the Webber Pond watershed. Public roadways accounts for a much greater percentage of the phosphorus load (6%) versus its land area (0.8%) in the Webber Pond watershed.

Low-Density Residential Homes: The Town of Vassalboro tax records and property tax maps were used to determine the number of residential dwellings within the Webber Pond watershed. An average lot size of one acre was used to estimate the residential land area for a total of 254 acres.

This land use is characterized by dispersed, low-density, single-family homes. Non-shoreline residential areas account for 4.8% of the total phosphorus load to Webber Pond.

Commercial: Commercial development within the watershed is limited to a small area – approximately 4 acres – consisting of a golf course clubhouse and paved parking lot, a used car lot, a small-engine repair shop, and a distribution center for Maine-made items**.** This land use accounts for less than 1% of the total phosphorus load to Webber Pond.

Institutional: There is an elementary school located at the corner of the Bog and Webber Pond roads in the northern portion of the watershed, encompassing approximately 25 acres. Built in the early 1990's, this project was reviewed under the Site Location of Development statute – the first application of a comprehensive site design for phosphorus control in Vassalboro (Michelle Jandreau, CEO, personal communication). There is also a church in Center Vassalboro that is located due east of Webber Pond. Institutional land areas account for less than 3% of the total phosphorus load to Webber Pond.

Golf Course: A popular golf course is located partly within the Webber Pond watershed and partly within the Sevenmile Stream watershed (that flows to the Kennebec River). The course lies on both sides of the Webber Pond Road within the Town of Vassalboro. The original 18-hole golf course was developed between 1965 and 1970, at which time no Site Location of Development permit was required. This portion of the course is irrigated with water from Webber Pond. The course was expanded from 18 to 27 holes after the applicant received site plan approval by Maine DEP in 1988. This expansion consisted of approximately 160 acres, with three of the nine holes located within the Webber Pond Watershed. Water for irrigating this section of the golf course is supplied by irrigation ponds located on the course (Maine DEP Order, 1988).

On-site detention for storm water runoff was deemed unnecessary for post-development runoff (Maine DEP 1998 Order of Conditions) at the golf course. Maine DEP granted approval on the condition that all fertilizers be quick solution fertilizers and "slow-release fertilizers containing phosphorus shall be limited to dry periods and shall be immediately followed by a light irrigation (to dissolve the phosphorus and tie it up in the soil)" (Maine DEP Findings of Fact and Order 1988). Several hundred feet of vegetation were to remain in place between the golf course and Webber Pond, with no formally designated buffer strips proposed.

Maine DEP granted approval to expand the golf course from 27 to 36 holes in year 2000, approximately a 100-acre expansion, and to modify four already-existing holes. This expansion converted several hay fields, a large chicken barn and forestland to a golf course. The expansion is located on the west side of the Webber Pond Road, mostly within the Sevenmile Stream watershed. Only the northeast corner of the project is within the Webber Pond watershed. The applicant was required to mitigate phosphorus impacts by removing the existing chicken barn and improving the phosphorus removal capability of an existing pond which outlets via a 24" culvert under the Webber Pond Road by way of an intermittent stream (seasonal runoff), eventually flowing into Webber Pond. In addition, three retention ponds were constructed for storm water runoff and

to further mitigate impact on wetlands.

During April of 2002, MACD project staff toured the golf course with the owner-manager in order to assess on-site NPS-BMPs. According to management, soil tests indicate adequate amounts of phosphorus in the soils so that very little, if any, phosphorus is used to fertilize the fairways, and very little is used on tees and greens. The "rough" areas of the course are not fertilized. Quick solution fertilizer containing phosphorus is generally applied when new turf is established.

The golf course is in close proximity to Webber Pond with a portion of the course (2 holes) directly adjacent to the lake, however separated from the lake by sloping fields and varying widths of natural vegetation. Much of the golf course within the Webber Pond watershed drains into retention ponds or streams that traverse the course – all of which have direct flow to the lake, at least on a seasonal basis. Golf course area (100 acres) was determined by aerial photos, Vassalboro town records and field verification. To estimate phosphorus loading attributable to the golf course area, the limited use of fertilizer containing phosphorus, as well as the varying amounts of fertilizer applied to tees, greens and "rough" area were taken into consideration. Total phosphorus loading estimates from the golf course area comprise 1.5% of the total land area and 6.1% of the total phosphorus load.

Overall, non-shoreline development accounts for 7% of the total land area and contributes about 20% of the total phosphorus load to Webber Pond.

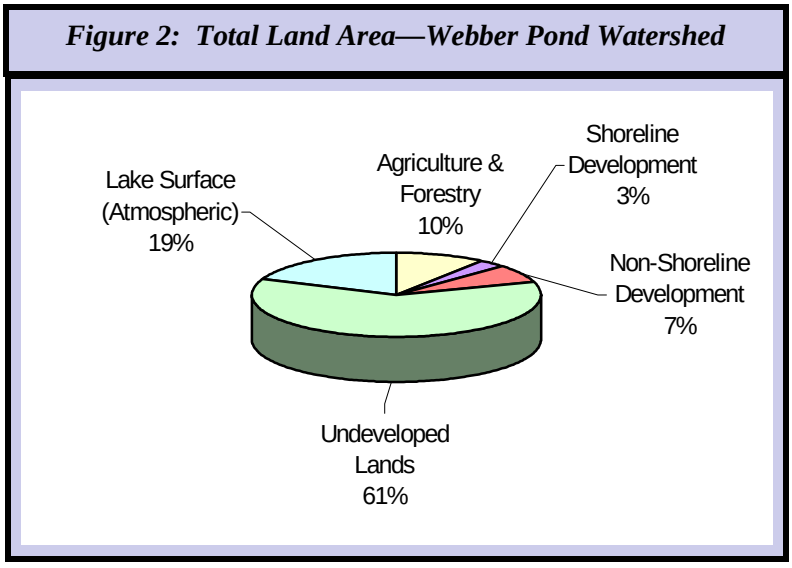
Phosphorus Loading from Undeveloped Lands

Forests: Of the total land area within the Webber Pond watershed, 48% (3,035 acres) is forested, characterized by privately-owned deciduous and mixed forest plots (KC-SWCD GIS, MACD 2002). About 9% of the phosphorus load is estimated to be derived from forested areas within Webber Pond's direct drainage area.

Other Undeveloped Land Areas: Combined wetlands, reverting fields, old field scrub shrub and bare land comprise accounts for the remaining 13% of the land area and 11% of the non-cultural total phosphorus export load.

Atmospheric Deposition (Open Water): Webber Pond surface waters (1,201 acres) comprise 19% of the total watershed area (6,371 acres), representing 15% of the total phosphorus load entering Webber Pond. Figure 2 (right) depicts the percentage of total land area covered by each land use.

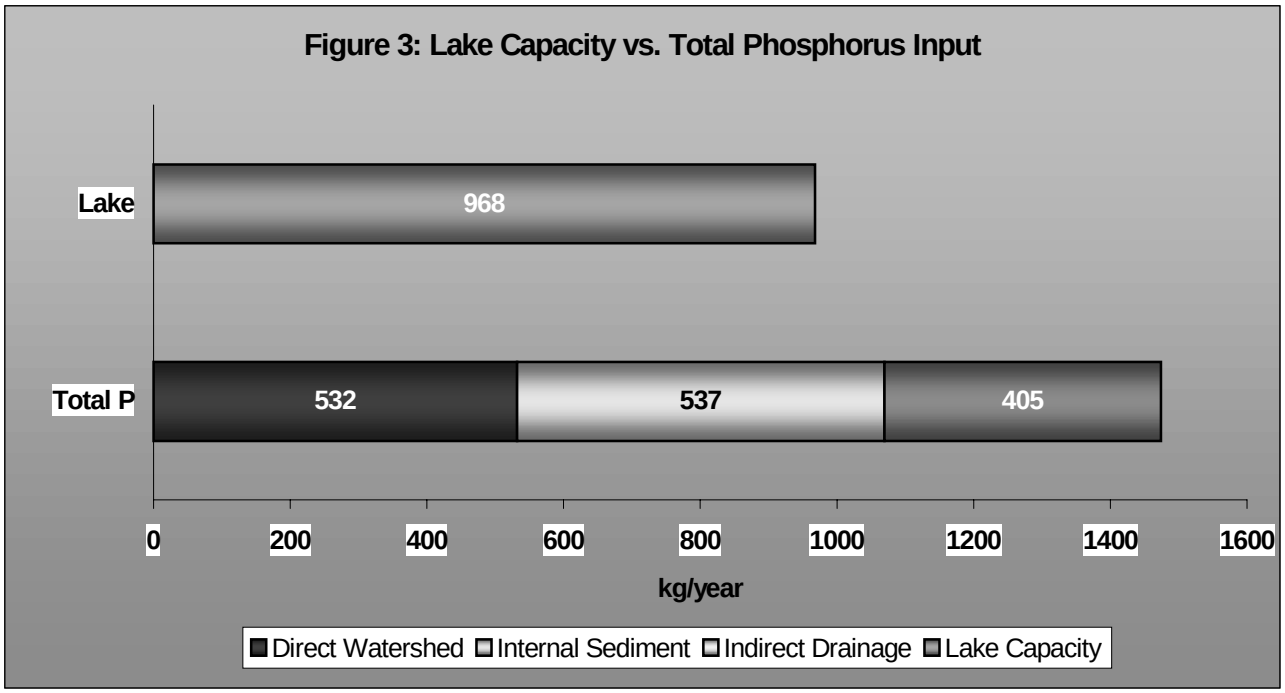
Figure 2: Total Land Area—Webber Pond Watershed



PHOSPHORUS LOADS – Watershed, Sediment and In-Lake Capacity

Supporting documentation for the phosphorus loading analysis includes the following: water quality monitoring data from Maine DEP and the Volunteer Lake Monitoring Program, and a phosphorus retention model (see Appendices for more detailed information).

- External total phosphorus loadings to Webber Pond originate from a combination of external (watershed + Threemile Pond) and internal (pond sediment) sources of total phosphorus (TP). External TP sources, averaging 532 kg annually have been identified and accounted for by land use (see above).
- Total phosphorus loading from the associated upstream Threemile Pond accounts for external loading from the indirect watershed of 405 kg annually, determined on the basis of *flushing rate x volume x TP concentration,* and typical area gauged streamflow calculations (Jeff Dennis, Maine DEP, personal communication).
- The relative contribution of internal sources of total phosphorus within Webber Pond - in terms of pond sediment total phosphorus recycling - range from 210 to 759 kg with an average annual value approximating 537 kg.
- The load allocation (lake assimilative capacity) for all existing and future non-point pollution sources for Webber Pond is 968 kg of total phosphorus per year, based on a target goal of 15 ppb. Figure 3 (below) depicts these estimates.



PHOSPHORUS CONTROLACTION PLAN

Webber Pond is a waterbody that has impaired water quality due mostly to nonpoint source (NPS) pollution and resultant internal sediment recycling of phosphorus. As such, specific recommendations regarding recent and current efforts in the watershed, Best Management Practices (BMPs), and actions to reduce external watershed total phosphorus loadings in order to improve water quality conditions in Webber Pond are as follows:

Recent and Current NPS/BMP Efforts

Maine DEP completed a Diagnostic Feasibility study (1981) for the Webber Pond watershed, inclusive of Threemile and Threecornered ponds. This study documented significant water quality impairment to the ponds as well as recommended steps for restoration. In 1983, KC-SWCD and USDA SCS (NRCS) produced the Webber Pond Watershed Plan. It included a listing of needed agricultural conservation practices in the watershed of Threemile, Threecornered and Webber ponds. Seven of 31 farms within the total Webber Pond watershed were designated as high priority for conservation measures. By 1991, four out of the seven had established soil and water conservation practices.

Substantial support was provided for the restoration of Webber and Threemile ponds under the Clean Lakes Program of EPA, under section 314 of the Clean Water Act. Maine DEP was awarded a Clean Lakes Grant in June of 1984 and the Webber Pond restoration project was outlined in a June 1991 Final Report by Maine DEP. The restoration work included enhanced seasonal drawdown, shoreline stabilization of thousands of feet of eroding banks and other NPS work including implementation of agricultural BMPs. This restoration project was supported by and included active participation by the Webber Pond Association , KC-SWCD, USDA NRCS and Town of Vassalboro.

In 1997 a volunteer watershed survey, sponsored by the Maine DEP and the CRLA, was completed for the Webber Pond watershed. The watershed was split into sectors and trained volunteers surveyed their sectors for evidence of soil erosion and sedimentation. Lower-than-expected volunteer turnout resulted in only 10% of the watershed being surveyed – namely, the developed portion on the east shoreline of the lake and a small portion on the west shoreline (CRLA 2002).

There were 32 problem sites identified in the 1997 survey, including 8 road-ditch-culvert problems, 2 stream erosion sites and 22 lake shoreline erosion sites and 1 “other” category site. By the end of 1998, 25 of the identified sites had been repaired and/or mitigated, including 20 of the shoreline sites, 1 of the stream bank sites and 4 of the road sites. These numbers do not include sites where work was done without the assistance of the CRLA or sites where technical assistance was provided but landowners did not report completed site repairs (CRLA 1999).

From June of 1997 to September of 1999, the China Region Lakes Alliance (CRLA) administered Phase II of the Webber and Threemile Ponds Watershed Project. (Phase I covers

Threemile Pond). During this three-year period, the CRLA worked to address existing sources of NPS pollution by providing information, offering technical assistance and repairing problem sites with the Webber Conservation Corps. Initially scheduled to last two years, this project was extended to three years with the support of town taxpayers. Part of this project entailed oversight of the Webber Pond Conservation Corps. During the three-year period 1997 to 1999, the Corps implemented 58 BMPs, including: 43 riprap jobs (mostly shoreline), 6 water bars installations on camp roads, 3 vegetative buffer plantings, 5 culvert stabilizations (rip-rap), 1 culvert maintenance, and 1 beach debris clean-up (CRLA 2001).

The Webber Pond Conservation Corps, sponsored by the CRLA, provides free labor to landowners for NPS pollution BMP implementation. The corps operates for an eight to 10-week period during the summertime. During the summer seasons 1999-2001, the Corps worked on 30 sites within the Webber Pond watershed as well as 2 camp road projects during the 2001 season. Work completed by the Corps includes rip-rap reinforcement of shorefront (27), shoreline stabilization (2), buffer strip plantings (5), and waterbar installation (2) (WPCC Seasonal Reports 1999 - 2001). During the 2002 season, the Corps completed 4 rip-rap jobs along the shoreline of Webber Pond (Reb Manthey, personal communication, 2002).

More recently, the CRLA has developed a Watershed Management Plan for China Lake, Threemile and Webber ponds for the 1998-2008 time period. The goal of this watershed management project is to restore and prevent further degradation of the water quality of the three lakes, as well as to educate local citizens about the effects of their activities on water quality (CRLA 1999). This project works to implement erosion control practices and provide technical assistance to watershed stakeholders. Future projects include the establishment of shoreline buffer strips, completing and updating watershed surveys, exploring options for watershed management sustainability without relying on federal funding, updating cover type and land use information and increasing educational efforts and outreach (CRLA 1999). Major elements of this project include: site selection and design, BMP project management, Conservation Corps activities, information and education, and continued water quality monitoring (adaptive management).

In December of 2000, the CRLA initiated the Camp Road Runoff Abatement Project . This project makes cost share funds available to organized road associations for help with road repairs. This project seeks to educate camp road users about the importance of good design and maintenance of camp roads and its direct connection to water quality. By the fall of 2002, six private/camp roads had BMPs implemented under this project, including waterbars, culvert replacement, crowning and ditching, at an estimated cost to landowners of $19,650 with $9,100 reimbursed by the CRLA.

Recommendations for Future Work

Watershed Management: Since the mid-1990's, the China Region Lakes Alliance (CRLA) has taken an active role in documenting and mitigating nonpoint source (NPS) pollution sites throughout the Webber Pond watershed. The last documented survey was performed in 1997 and the CRLA Watershed Management Plan (1998 - 2008) outlines future plans for surveying the watershed for potential NPS pollution sites. This plan can help achieve locally supported watershed management programs to facilitate widespread implementation of BMPs or other management measures in order to reduce or eliminate NPS pollution in Webber Pond. The Webber Pond Association, watershed residents, municipal officials and the Maine DEP should support the CRLA in its continued efforts to implement the Watershed Management Plan.

Action Item # 1: Coordinate Existing Watershed Management Efforts		
Activity	**Participants**	**Schedule & Cost**
Develop a Webber Pond Leadership Team	CRLA, KCSWCD, WPA, MDEP, municipalities, local business, watershed citizens	Annual Roundtable Meetings beginning in 2003—**minimal cost**

Shoreline residential areas have the potential to negatively impact the water quality of Webber Pond. The 2001 MACD shoreline survey found that many of the residential shoreline lots have inadequate or nonexistent vegetative buffers. Many of the shoreline areas have been adequately rip-rapped, however, there is a noticeable lack of vegetative plantings above these rip-rapped areas, necessary to decrease and slow run-off from shore land sites. An effort should be undertaken to encourage landowners to establish adequate and effective vegetated buffers along

Action Item # 2: Implement a Buffer Awareness and Planting Campaign		
Activity	**Participants**	**Schedule & Cost**
Develop a Buffer Awareness Campaign for Watershed Citizens	CRLA, KCSWCD, WPA, MDEP, watershed citizens, local nurseries	Annually beginning in 2003 **$5,000/yr**

the shoreline. Free technical assistance by the CRLA, the KC-SWCD, and free labor provided by the Webber Pond Conservation Corps should be well-publicized to all shoreline landowners.

Roadways: Few camp roads are designed and maintained properly and can be a major source of erosion and sedimentation to the lake. During the MACD Webber Pond watershed inventory in

Action Item # 3: Implement Camp Road Best Management Practices		
Activity	**Participants**	**Schedule & Cost**
Continue to Implement Roadside BMPs watershed-wide	CRLA, KCSWCD, WPA, MDEP, watershed road associations	Annually beginning in 2003 **$10,000/yr**

2001, six camp roads were noted as potential NPS sites. Road problems noted include moderate to severe surface erosion, poor shaping, moderate to severe shoulder erosion and an unstable culvert. For free technical assistance about proper camp road maintenance and potential cost-share funds, contact the CRLA (China Town Offices) or the KC-SWCD (Augusta).

Agriculture: Since the early 1980's, the Kennebec County Soil and Water Conservation District and the USDA Natural Resources Conservation Service (NRCS) have worked cooperatively with landowners to install conservation practices in the watershed. For free technical assistance, potential cost-share funds or for more information about proper agricultural BMPs, contact the KC-SWCD or NRCS offices in Augusta.

Forestry: Landowners, loggers and foresters working within the watershed should contact the Maine Forest Service (1-800-367-0223) for a copy of Forestry BMP guidelines and other forest management assistance. Special attention should be given to forest access roads and proper erosion control measures should be utilized.

Action Item # 4: Conduct Workshops for Agriculture and Forestry Operators		
Activity	**Participants**	**Schedule & Cost**
Conduct workshops encouraging the use of phosphorus control measures	CRLA, KCSWCD, NRCS, MFS, forestry and agriculture community	Annually beginning in 2003 **$1,000/yr**

Non-shoreline residential and commercial properties should be considered as potential problem areas for phosphorus input, especially those adjacent to Webber Pond watershed brooks and streams. These areas should be included in future education and outreach efforts as all residents within the watershed will benefit from improved water quality in Webber Pond.

Action Item # 5: Develop Stewardship Initiatives for Webber Pond Tributaries		
Activity	**Participants**	**Schedule & Cost**
"Adopt" local streams to promote stewardship efforts including education and water quality monitoring	CRLA, KCSWCD, MDEP Stream Team, local schools, golf courses, and watershed citizens	Annually beginning in 2003 **$500/yr**

Individual action by all watershed residents should be encouraged through continued education and outreach efforts, including: retention or planting of natural vegetation of buffer strips, use of non-phosphate cleaning detergents, elimination of phosphorus-containing fertilizers, adequate maintenance of septic systems.

Action Item # 6: Expand Homeowner Education and Technical Assistance Programs		
Activity	**Participants**	**Schedule & Cost**
Increase outreach and education efforts to watershed citizens including technical assistance to landowners	CRLA, KCSWCD, WPA	Annually beginning in 2003 **$1,500/yr includes printing of educational materials**

Municipal actions should include ensuring public compliance with local and state water quality laws and ordinances (Shoreland Zoning, Erosion and Sedimentation Control Law, plumbing code) through education and enforcement action, when necessary.

Water Level Management: The continuance of annual late summer-early fall pond drawdown is an important means for partially controlling total phosphorus concentrations in Webber pond via the annual flushing of phosphorus-laden algae from the lake. This management tool, if properly applied (e.g., maximum water release at the time of highest TP content in the water column: late August, early September) should be an effective means for helping to restore water quality, along with a significant reduction in the external watershed loads in both Webber and Threemile ponds.

Action Item # 7: Utilize Water Level Management Plan		
Activity	**Participants**	**Schedule & Cost**
Utilize existing water level plan for phosphorus control /keep log of drawdown dates and amounts	WPA, MDEP	2003-2004 **No cost**

WATER QUALITY MONITORING PLAN: Historically, the water quality of Webber Pond has been monitored via measures of Secchi disk transparencies during the open water months since 1975 (DEP and VLMP). Continued long-term water quality monitoring within Webber Pond will be conducted monthly, from May to October, through the continued efforts of the Maine Volunteer Lake Monitoring Program (VLMP) in cooperation with Maine DEP. Under this planned, post-TMDL water quality-monitoring scenario, sufficient data will be acquired to adequately track seasonal and inter-annual variation and long-term trends in water quality in Webber Pond. A post-TMDL adaptive management status report will be prepared five to ten years following EPA approval.

Closing Statement

The China Region Lakes Alliance, along with the Webber Pond Association and Conservation Corps, has worked since the mid-1990's addressing NPS pollution sites in the watershed. Technical assistance and grant funding, when available, are provided by the China Region Lakes Alliance to mitigate identified NPS pollution sources. The Kennebec County Soil & Water Conservation District has taken an active role in water quality and conservation issues in the County by hosting watershed-wide conservation meetings as well as creating and supporting an informative and educational web site. The CRLA and the WPA educate watershed landowners through newsletter publication. The Town of Vassalboro has been successful with its septic system component of its shoreland zoning ordinance – for an estimated 95% compliance. The Town of Vassalboro should be commended and remain diligent in its efforts to protect its water resources. Actions taken by the shoreline landowners to comply with this shore-land zoning ordinance should be commended as well. The extent of technical and financial resources available to watershed residents indicates that there is a high probability that future BMP implementation will continue to take place as long as watershed residents remain informed and motivated to take part in restoring and enhancing the water quality of Webber Pond.

Webber Pond Phosphorus Control Action Plan

APPENDICES

Introduction to Maine Lake TMDLs

A. Water Quality, Priority Ranking, and Algae Bloom History

B. Natural Environmental Background Levels

C. Water Quality Standards and Target Goals

D. Estimated Phosphorus Export by Land Use Class and Table 3

E. Linking Water Quality and Pollutant Sources

F. Load (LA) and Wasteload (WL) Allocations and Figure 3

G. Margin of Safety and Reasonable Assurance

H. Seasonal Variation

I. Watershed Phosphorus Control and Future Development

J. Public Participation and Review Comments

K. Webber Pond Specific and General Technical References

Maine Lake TMDLs - Phosphorus Control Action Plans (PCAPs)

You may be wondering what the acronym 'TMDL' represents and what it is all about. TMDL is actually short for 'Total Maximum Daily Load.' This information, no doubt, does little to clarify TMDLs in most people's minds. However, when we think of this as an annual phosphorus load (*Annual Total Phosphorus Load),* it begins to make more sense.

Simply stated, excess nutrients or phosphorus in lakes promote nuisance algae growth/blooms - resulting in the violation of water quality standards as measured by water clarity depths of less than 2 meters. A lake TMDL is prepared to estimate the total amount of total phosphorus that a lake can accept on an annual basis without harming water quality. Historically, development of TMDLs was first mandated by the Clean Water Act in 1972, and was applied primarily to *point sources* of water pollution. As a result of public pressure to further clean up water bodies, lake and stream TMDLs are now being prepared for watershed-generated *Non-Point Sources* (NPS) of pollution.

Nutrient enrichment of lakes through excess total phosphorus originating from watershed soil erosion has been generally recognized as the primary source of NPS pollution. Major land use activities contributing to the external phosphorus load in lakes include residential-commercial developments, roadways, agriculture, and commercial forestry. Statewide, there are 38 lakes in Maine which do not meet water quality standards due to excessive amounts of in-lake total phosphorus.

The first Maine lake TMDL was developed (1995) for Cobbossee Lake by the Cobbossee Watershed District (CWD) - under contract with Maine DEP and US-EPA. TMDLs have been approved by US-EPA for Madawaska Lake (Aroostook County), Sebasticook Lake, East Pond (Belgrade Lakes), and China Lake. PCAP-TMDLs are presently being prepared by Maine DEP, with assistance from the Maine Association of Conservation Districts (MACD) and County Soil and Water Conservation Districts (SWCDs) - for Mousam and Highland Lakes in southern Maine (final EPA review). Ongoing PCAP-TMDL lake studies include: Long & Highland lakes (Bridgton); Annabessacook & Little Cobbossee lakes & Pleasant & Upper Narrows Ponds - the latter four under separate contract with CWD. A non-MACD supported PCAP-TMDL for Unity Pond (Waldo County) is being developed with the assistance of Unity College staff. PCAP-TMDL studies have also been initiated for Sabattus, Togus, and Lovejoy ponds.

Lake TMDL reports are based in part on available water quality data, including seasonal measures of total phosphorus, chlorophyll-a, Secchi disk transparencies, and dissolved oxygen-water temperature profiles. Actual reports include: a lake description; watershed GIS assessment and estimation of NPS pollutant sources; selection of a total phosphorus target goal (acceptable amount); allocation of watershed/land-use phosphorus loadings, and a public participation component to allow for stakeholder review.

TMDLs are important tools for maintaining and protecting acceptable lake water quality. They are primarily designed to 'get a handle' on the magnitude of the NPS pollution problem and to develop plans for implementing Best Management Practices (BMPs) to address the problem. *Development of phosphorus-based lake TMDLs are not intended by Maine DEP to be used for regulatory purposes*. Landowners and watershed groups are eligible to receive technical and financial assistance from state and federal natural resource agencies to reduce watershed total phosphorus loadings to the lake.

A. Water Quality Monitoring: (Source: Maine DEP and VLMP 2002) Water quality monitoring data for Webber Pond has been collected annually since 1975. This water quality assessment is based on 27 years of Secchi disk transparency (SDT) measures, combined with 14 years of epilimnion core total phosphorus (TP) data, 12 years of water chemistry and 25 years of chlorophyll-a monitoring data.

Water Quality Measures: (Source: Maine DEP and VLMP 2002) Webber Pond has a range of SDT measures from 0.4 to 5.6 meters, with an average of 2.8 m, an epilimnion core TP range of 14 to 35 with an average of 25 parts per billion (ppb), and chlorophyll-a measures ranging from 2 to 85, with an average of 13 ppb. Recent dissolved oxygen (DO) profiles indicate low levels of DO in deep areas of the lake. Late summer dissolved oxygen levels in 2001 remained fairly low (0-4 ppm) with 50% of the water column (lower 6 meters) unsuitable for salmonid species (e.g., brown trout). The potential for total phosphorus to leave the bottom sediments and become available to algae in the water column (internal loading) is moderate to high (Maine DEP 2001). Together, these data indicate a documented trend of increasing trophic state and hence a violation of the Class GPA water quality criteria requiring a stable or decreasing trophic state.

Priority Ranking, Pollutant of Concern and Algae Bloom History: Webber Pond is listed on the State's 1998 303(d) list of waters in non-attainment of Maine state water quality standards. The Webber Pond TMDL has been developed for total phosphorus, the major limiting nutrient to algae growth in freshwater lakes in Maine.

The water quality of Webber Pond during the summers of 2001-02 appear to be unimproved in contrast to 2000 and the preceding 25 years of record. Minimum transparencies dropped to 1.2 meters (2.8 average) and total phosphorus (23 ppb) and chlorophyll-a (mean 19.9 ppb) levels remained fairly high. Nuisance algae blooms were prevalent during the summer of 2002.

B. NATURAL ENVIRONMENTAL BACKGROUND levels for Webber Pond were not separated from the total nonpoint source load because of the limited and general nature of available information. Without more and detailed site-specific information on nonpoint source loading, it is very difficult to separate natural background from the total nonpoint source load (US-EPA 1999). There are no known point sources of pollutants to Webber Pond (MACD 2002).

C. WATER QUALITY STANDARDS & TARGET GOALS

Maine State Water Quality Standard for nutrients which are narrative, are as follows *(July 1994 Maine Revised Statutes Title 38, Article 4-A*): "Great Ponds Class A (GPA) waters shall have a stable or decreasing trophic state (based on appropriate measures, e.g., total phosphorus, chlorophyll a, Secchi disk transparency) subject only to natural fluctuations, and be free of culturally induced algae blooms which impair their potential use and enjoyment."

Maine DEP's functional definition of nuisance algae blooms include episodic occurrence of Secchi disk transparencies (SDTs) < 2 meters for lakes with low levels of apparent color (<26 SPU) and for higher color lakes where low SDT readings are accompanied by elevated chlorophyll a levels. Webber Pond is a non-colored lake (average color 20 SPU), with an average SDT of 2.8 m (9.2 feet), in association with elevated average chlorophyll a levels of 12.7 ppb (1975 -2001). Currently, Webber Pond does not meet water quality standards due to annual summertime nuisance algae blooms, hence a continued trend of increasing trophic state. This water quality assessment uses historic documented conditions as the primary basis for comparison. Given the context of "impaired use and enjoyment," along with a realistic interpretation of Maine's goal-oriented Water Quality Standards (WQS), Maine DEP has determined that episodic, non-cyanobacteria based algae blooms (e.g. diatoms), limited to the fall or spring periods only, are in WQS attainment for GPA waters.

Designated Uses and Antidegradation Policy: Webber Pond is designated as a GPA (Great Pond Class A) water in the Maine DEP state water quality regulations. Designated uses for GPA waters in general include: water supply; primary/secondary contact recreation (swimming and fishing); hydro-electric power generation; navigation; and fish and wildlife habitat. No change of land use in the watershed of a Class GPA water body may, by itself or in combination with other activities, cause water quality degradation that would impair designated uses of downstream GPA waters or cause an increase in their trophic state. Maine's anti-degradation policy requires that "existing in-stream water uses, and the level of water quality necessary to sustain those uses, must be maintained and protected."

Numeric Water Quality Target: The water quality goal for Highland Lake is to halt its trend of increasing trophic state so that it can meet the standard of stable or decreasing trophic state. The The numeric (in-lake) water quality target for Webber Pond, to meet this goal, is set at 15 ppb total phosphorus (968 kg TP/yr). Since numeric criteria for phosphorus do not exist in Maine's water quality regulations - and would be less accurate targets than those derived from this study - we employed best professional judgment to select a target in-lake total phosphorus concentration that would attain the narrative water quality standard. Spring-time (late April – early May) total phosphorus levels in Webber Pond approximated 15 ppb during the time period 1999-2002. In direct contrast, in-lake (epilimnion core) total phosphorus summer-time (June through August) measures averaged 18-25 ppb (severe algal bloom conditions). In summary, the numeric water quality target goal of 15 ppb for total phosphorus in Webber Pond was based on available late spring – early summer pre water column stratification data, generally corresponding to non-bloom conditions, as reflected in suitable (water quality attainment) measures of both Secchi disk transparency (> 2.0 meters) and chlorophyll-a (< 8.0 ppb).

D. ESTIMATED PHOSPHORUS EXPORT BY LAND USE CLASS

Table 4 details the numerical data used to determine external phosphorus loading for the Webber Pond watershed. The key below explains the columns and the narrative that follows the table (pages 31-32) explains each of the land use categories.

Key for Columns depicted in Table 4

Land Use: The land use category that was analyzed for this report

Total Area Acres: The area of each land use as determined by GIS mapping, aerial photography, Delorme Topo USA software, and field reconnaissance.

Total Area Hectares: One Acre = .404 hectares

TP Coeff. Avg kg/P/ha: The selected coefficient for each land use category. The Total Phosphorus coefficient is determined from previous research – usually the median value if it is listed by the author. The coefficient is often adjusted using best professional judgment based on conditions including soil type, slope, and BMPs installed.

TP Coeff. Avg kg TP: = Total Hectares x TP Coefficient

TP Coeff. Range kg/P/ha: The range of the coefficient values listed in the various literature associated with the corresponding land use.

Tot Land Area %: The percentage of the watershed covered by the land use.

TP Exp Avg %: The percentage of estimated Phosphorus export by the land use.

Table 4: Estimated total phosphorus export by land use class for the Webber Pond direct watershed in Vassalboro

LAND USE	Total Area Acres	Total Area Hectares	TP Coeff. Avg. kg/P/ha	TP Exp. Avg. kg TP	TP Coeff. Range kg/P/ha	Tot Land Area %	TP Exp Avg %
Agricultural and Forestry practices							
Cropland	121	49	1.5	73.6	0.26 - 18.6	1.9%	13.8%
Hayland	175	71	0.65	46.0	0.65 - 2.9	2.7%	8.7%
Low-Intensity Hayland	149	60	0.20	12.1	0.2 - 0.6	2.3%	2.3%
Orchard	11	4	0.40	1.7	0.06 - 0.75	0.2%	0.3%
Pasture	61	25	0.81	19.9	0.14 - 4.9	1.0%	3.7%
Operated Forestland	170	69	0.4	27.5	0.2 - 0.6	2.7%	5.2%
Sub-totals	**687**	**278**		**181**		**11%**	**34%**
Shoreline development							
Low impact residential	28	11	0.25	2.8	0.25 - 1.75	0.4%	0.5%
Medium impact residential	44	18	0.5	8.8	0.4 - 2.2	0.7%	1.7%
High impact residential	10	4	0.7	2.7	0.56 - 2.7	0.1%	0.5%
Septic Systems	Webber	Septic	Model	12	12 - 36		2.3%
Camp & Private Roads	30	12	2	24.5	0.63 - 10.1	0.5%	4.6%
Recreational	49	20	0.5	10.0	0.14 - 4.9	0.8%	1.9%
Sub-totals	**161**	**65**		**61**		**3%**	**11%**
Non-shoreline development							
State Roads	2	1	1.5	1.1	0.63 - 10.1	0.0%	0.2%
Town Roads	51	21	1.5	30.8	0.63 - 10.1	0.8%	5.8%
Low Density Residential	254	103	0.25	25.7	0.25 - 1.75	4.0%	4.8%
Commercial	4	2	1.5	2.4	0.77 - 4.18	0.1%	0.5%
Institutional	25	10	1.5	15.2	0.77 - 4.18	0.4%	2.9%
Golf Course - tees and greens	3	1	4.5	4.6	1.55 - 4.50	0.0%	0.9%
Golf Course - fairways	12	5	0.7	3.4	1.55 - 4.50	0.2%	0.6%
Golf Course - other areas	86	35	0.7	24.2	1.55 - 4.50	1.3%	4.6%
Sub-totals	**436**	**176**		**107**		**7%**	**20%**
Total Ag/Forestry/Development	**1,283**	**520**		**349**		**20%**	**65%**
Inactive/Passively Managed Forest	3035	1228	0.04	49.1	0.02 - 0.05	47.6%	9.2%
Wetlands	208	84	0.2	16.8	0.02 - 0.83	3.3%	3.2%
Scrub Shrub	355	144	0.1	14.4	0.1 - 0.8	5.6%	2.7%
Reverting Fields	285	115	0.2	23.1	0.1 - 0.8	4.5%	4.3%
Bare Land	4	1	0.98	1.4		0.1%	0.3%
Undeveloped	**3,887**	**1,573**		**105**		**61%**	**20%**
Total Open Water	**1,201**	**486**	0.16	**78**	0.11 - 0.21	**19%**	**15%**
TOTAL DIRECT WATERSHED	**6,371**	**2,578**		**532**		**100%**	**100%**

Total Phosphorus Land Use Loads

Estimates of total phosphorus export from different land uses found in the Webber Pond direct watershed are presented in Table 4 representing the extent of current external phosphorus loading to the lake. Total phosphorus loading from the associated upstream Threemile Pond accounts for loading from the indirect watershed (405 kg/TP/yr), determined on the basis of *flushing rate x volume x TP concentration,* and typical area gauged streamflow calculations (Jeff Dennis, personal communication).

Total phosphorus loading measures are expressed as a range of values to reflect the degree of uncertainty generally associated with such relative estimates (Walker 2000). The watershed total phosphorus loadings were primarily determined using literature and locally-derived export coefficients as found in Schroeder (1979), Reckhow et al. (1980), Dennis (1986), Dennis et al. (1992), and Bouchard et al. (1995) for residential properties, roadways, agriculture and other types of land uses (recreational, commercial).

Selected (range of) phosphorus loading coefficients in Table 4 have been adjusted for the estimated bioavailability of the runoff sources according to available literature (Lee et al. 1980 and Sonzogni et al. 1982) and tempered by best professional judgment (Jeff Dennis, Maine DEP, personal communication). Substantial changes include shoreline roads and residential development (approximately 50% reduction from total to bioavailable phosphorus). However, these changes do not effectively alter the conclusions and recommendations of the PCAP-TMDL report regarding identified needs and implementation plans for required watershed NPS/BMPs.

Agricultural/Forest Operational Practices: Total phosphorus loading coefficients applied to agricultural practices were adopted from Reckhow (hay land .65 kg/TP/ha, pasture 0.81 kg/TP/ha) and Dennis (low-intensity hayland 0.2 kg/TP/ha) and from Maine DEP (1989) studies (row crops 1.5 kg/TP/ha). The total phosphorus loading coefficient applied to operated forestlands was adopted directly from the earlier Annabessacook Lake 1977 study (0.4 kg/P/ha).

Shoreline Residential Lots (House and Camp): The range of total phosphorus loading coefficients used (0.25 – 2.7 kg/ha/yr) were developed using information on residential lot stormwater export of algal available phosphorus from Dennis et al (1992) .

Private Camp Roads: Total phosphorus loading coefficients for private camp roads (2.0 kg/TP/ ha) were chosen based on studies from rural Maine highways (Dudley et al. 1997).

Public Roadways: Town and state roadways (21 ha) were assigned a total phosphorus loading rate of 1.5 kg per hectare per year. This coefficient was chosen based on studies from rural Maine highways (Dennis, 2002).

Non-Shoreline Development: Non-shoreline residential areas in the watershed are best characterized as low density residential - reflected in the 0.25 TP loading coefficient.

The total phosphorus loading coefficient range (0.5 – 4.5 kg/TP/ha) applied to the golf course area takes into account the varying amounts of fertilizer used on tees, greens, fairways and "rough". The lower coefficients also reflect the limited use of fertilizer containing phosphorus, the minimal amount of soil erosion taking place during spring runoff, as well as proximity to the resource and the area drained with direct flow to the lake.

Total Cultural Phosphorus Loading: A total of 69% (404 kg) of the total phosphorus loading to Webber Pond is estimated to have been derived from the cumulative effect of the preceding cultural land use classes: agriculture and forestry (34% - 181 kg); roadways (9.6% - 56.4 kg), non-shoreline development (20% - 107 kg) and shoreline development (11% - 61 kg), including septic systems (2.3% - 12 kg) and camp/private roads (4.6% - 24.5 kg) – as depicted in Table 2.

Non-Cultural Phosphorus Loading: The Phosphorus export coefficient for forested land (0.04) is based on a regional study (Likens et al 1977). The lower total phosphorus loading coefficient chosen for atmospheric deposition (0.16 kg/P/ha) is similar to that used for the China Lake TMDL (Kennebec County), while the upper range (0.21 kg/P/ha) generally reflects a watershed that is 50 percent forested, combined with agricultural areas interspersed with urban/ suburban land uses (Reckhow et al. 1980). Other Non-Cultural Land Uses: Combined wetlands, grassland, old field scrub shrub and bare land comprise accounts for the remaining 7% (56 kg) of the total non-cultural total phosphorus export load – 105 kg.

Atmospheric Deposition and Dry Fallout: Webber Pond surface waters (486 ha) comprise 19% of the total watershed area (2,578 ha) and account for an estimated 78 kg of total phosphorus, representing 15% of the total load entering Webber Pond.

It is our best professional opinion that the selected export coefficients are appropriate for the Webber Pond watershed. Results of the land use analysis indicate that a best estimate of the present total phosphorus loading from external (watershed generated) nonpoint source pollution averages 532 kg TP/yr. This 'average' annual external watershed generated loading to Webber Pond equates to a total phosphorus loading modeled at 12 ppb (775 kg TP/year) - approximately 200 kg below the TMDL target goal of 15 ppb (968 kg TP/year).

E. LINKING WATER QUALITY & POLLUTANT SOURCES

Loading Capacity: The Webber Pond phosphorus loading assimilative capacity, which is intended to reflect the annual phosphorus loading responsible for current trophic conditions, is set at 968 kg TP/yr of total phosphorus, based on a long term goal of maintaining average phosphorus concentrations at or below 15 ppb. As specified in 40 C.F.R. 130.2(i), TMDLs may be expressed in terms of either mass per unit time, toxicity, or other appropriate measures. It is thought appropriate and justifiable to express the Webber Pond TMDL as an annual load because the lake basin has a relatively long hydraulic residence time (1.52), the average flushing rate for Maine lakes.

Linking Pollutant Loading to a Numeric Target: The basin loading assimilative capacity for Webber Pond was set at 968 kg/yr of total phosphorus to meet the numeric water quality target of 15 ppb of total phosphorus. A phosphorus retention model, calibrated to in-lake phosphorus data, was used to link phosphorus loading to numeric target.

Supporting Documentation for the Webber Pond TMDL Analysis includes the following: Maine DEP and VLMP water quality monitoring data, and specification of a phosphorus retention model – including both empirical models and retention coefficients.

Total Phosphorus Retention Model (after Dillon and Rigler 1974 and others)

L = P (A z p) / (1-R) where,

968 = **L** = external total phosphorus load capacity (kg TP/year)
15.0 = **P** = spring overturn total phosphorus concentration (ppb)
4.86 = **A** = lake basin surface area (km^2)
4.80 = **z** = mean depth of lake basin (m) **A z p = 35.5**
1.52 = **p** = annual flushing rate (flushes/year)
0.55 = **1- R** = phosphorus retention coefficient, where:
0.45 = **R = 1 / (1+ sq.rt. p)** (Larsen and Mercier 1976)

Previous use of the Vollenwieder (Dillon and Rigler 1974) type empirical model for Maine lakes, e.g., Cobbossee, Madawaska, Sebasticook, East Pond, China Lake, Mousam, and Highland lake TMDLs (ME-DEP 2000-2002) have shown this approach to be effective in linking watershed total

phosphorus (external) loadings to existing in-lake total phosphorus concentrations.

Strengths and Weaknesses in the Overall TMDL Analytical Process: The Webber Pond TMDL was developed using existing lake water quality monitoring data, derived watershed export coefficients (Reckhow et al. 1980, Maine DEP 1981 and 1989, Dennis 1986, Dennis et al. 1992, Bouchard et al. 1995, Soranno et al. 1996, and Mattson and Isaac 1999) and a phosphorus retention model which incorporates both empirically derived and observed retention coefficients (Vollenwieder 1969, Dillon 1974, Dillon and Rigler 1974 a and b, and 1975, Kirchner and Dillon 1975). Use of the Larsen and Mercier (1976) total phosphorus retention term, based on localized data (northeast and north-central U.S.) from 20 lakes in the US-EPA National Eutrophication Survey (US-EPA-NES) provides a more accurate model for northeastern regional lakes.

Strengths:

- Approach is commonly accepted practice in lake management
- Makes best use of available water quality monitoring data

- Based upon experience with other lakes in the northeastern U.S. region, the empirical phosphorus retention model was determined to be appropriate for the application lake.

Weaknesses:

- Inherent uncertainty of TP load estimates (Reckhow 1979, Walker 2000) and associated variability and generality of TP loading coefficients.

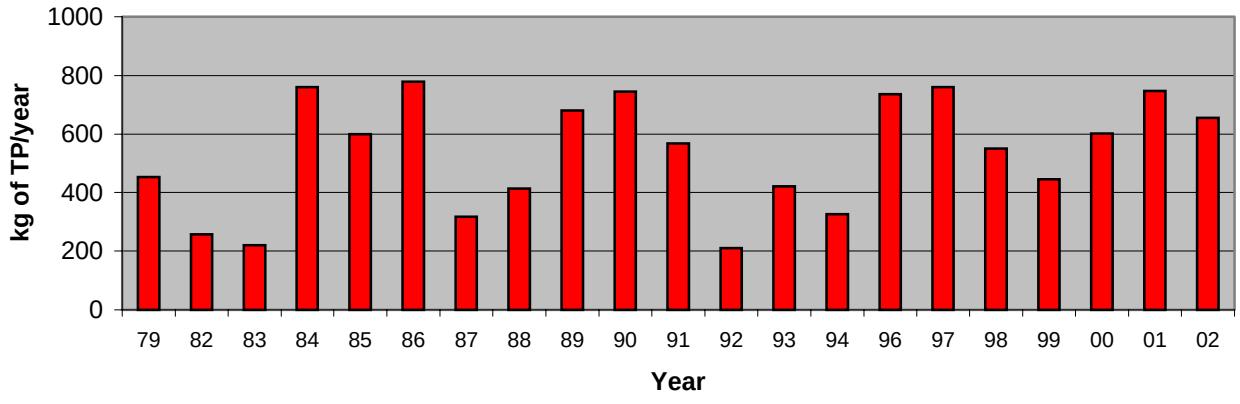
- Absence of TP loading coefficients for possible shoreline erosion contribution.

- Inherent uncertainty of phosphorus bioavailability estimates on different land use class p-loading and effect on model predictions.

Critical Conditions

Critical conditions in Webber Pond occur during the summertime, when the potential (frequency and occurrence) of nuisance algae blooms are greatest. The loading capacity of 15 ppb of total phosphorus was set to achieve desired water quality standards during this critical time period, and will also provide adequate protection throughout the year (see Seasonal Variation section).

Figure 4: Webber Pond Internal Load Sediment TP



F. LOAD ALLOCATIONS (LA's) The load allocation (lake assimilative capacity) for all existing and future non-point pollution sources for Webber Pond is 968 kg TP/yr, as derived from the empirical phosphorus retention model based on a target goal of 15 ppb (see Loading Capacity discussion). Reductions in nonpoint source phosphorus loadings are expected from the continued implementation of best management practices (see summary page 22-26). As previously mentioned, it was not possible to separate natural background from nonpoint pollution sources in this watershed because of the limited and general nature of the available information. As in other Maine TMDL lakes (see Sebasticook Lake, East Pond, and China Lake TMDLs), in-lake nutrient loadings in Webber Pond originate from a combination of external (watershed + Threemile Pond) and internal (sediment) sources of total phosphorus. External TP sources, averaging 532 kg annually have been identified and accounted for in the land-use breakdown portrayed in Table 4.

Internal Lake Sediment Phosphorus Load: The relative contribution of internal sources of total phosphorus within Webber Pond - in terms of sediment TP recycling - were analyzed (using lake volume-weighted mass differences between early and late summer) and estimated on the basis of water column TP data from 1991 to 2001 (Figure 4, previous page). Approximate internal sediment TP loads for this 10-year period (1995 missing) ranged from 210 to 759 kg with an average annual value of 537 kg. Internal sediment loads estimates for the previous decade (1979-1990, 1981 missing) quite similarly ranged from 220 to 779 (sans 1,370 kg outlying value from 1980), with a very similar average annual value of 536 kg (Maine DEP 1991). During these years, fairly complete lake profile TP concentration measures were available to derive reliable estimates of internal lake loads. The similarity between these two time periods indicates that, over the past two decades (1979 to 2001), the amount of TP being released from the sediments of Webber Pond, during the summer period, has been fairly regular and approximates over one-half of Webber Pond's capacity for in-lake phosphorus assimilation (968 kg TP/year).

WASTE LOAD ALLOCATIONS (WLA's): As there are no known existing point sources of pollution in the Webber Pond watershed, the waste load allocation for all existing and future point sources is set at 0.

G. MARGIN OF SAFETY (MOS): An implicit margin of safety was incorporated into the Webber Pond TMDL through the conservative selection of the numeric water quality target, as well as the selection of relatively conservative phosphorus export loading coefficients for cultural pollution sources (Table 3). Based on both the Webber Pond historical records and a summary of statewide Maine lakes water quality data for non-colored (< 26 SPU lakes) - the target of 15 ppb (968 kg TP/yr in Webber Pond) represents a highly conservative goal to assure attainment of Maine DEP water quality goals of non-sustained and non-repeated blue-green summer-time algae blooms due to NPS pollution or cultural eutrophication and stable or decreasing trophic state. The statewide data base for uncolored Maine lakes indicate that summer nuisance algae blooms (growth of algae which causes Secchi disk transparency to be less than 2 meters) are more likely to occur at 18 ppb or above. The difference between the in-lake target of 15 ppb (968 kg) and 17 ppb (1,096 kg), or 128 kg, represents a 12-13% implicit margin of safety for Webber Pond. An additional unquantified margin of safety for attainment of state water quality goals is also provided by the inherently conservative methods used by Maine DEP to estimate future growth (see Appendix I).

H. SEASONAL VARIATION: The Webber Pond TMDL is protective of all seasons, as the allowable annual load was developed to be protective of the most sensitive time of year – during the summer, when conditions most favor the growth of algae and aquatic macrophytes. With an average hydraulic retention time of 1.52 flushes/year, the average annual phosphorus loading is most critical to the water quality in Webber Pond. Maine DEP lake biologists, as a general rule, use more than six flushes annually (bi-monthly) as the cutoff for considering seasonal variation as a major factor (to distinguish lakes vs. rivers) in the evaluation of total phosphorus loadings in aquatic

environments in Maine. Nonpoint source best management practices (BMPs) proposed for the Webber Pond watershed have been designed to address total phosphorus loading during all seasons.

I. WATERSHED PHOSPHORUS CONTROL AND FUTURE DEVELOPMENT: The Maine DEP water quality goal of maintaining a stable trophic state includes a reduction of current P-loading which accounts for recent P-loading and potential future development in the watershed. The methods use by Maine DEP to estimate future growth (Dennis et al. 1992) are inherently conservative, as they provide for relatively high-end regional growth estimates and largely un-mitigated P-export from new development. This provides an additional unquantified margin of safety for attainment of state water quality goals.

J. PUBLIC PARTICIPATION: Adequate ('full and meaningful') public participation in the Webber Pond TMDL development process was ensured - during which land use and phosphorus load reductions were discussed - through the following avenues:

1. From December of 2001 to August of 2002, MACD project team member Jodi Michaud Federle attended CRLA board meetings. Updates on the lake TMDL development process were provided. (*The board is made up of members of the lake associations of Webber Pond, Threemile Pond, Threecornered Pond and China Lake, as well as the Kennebec Water District and the meetings are attended by the Executive Director of the CRLA).*

2. MACD project team member Jodi Michaud Federle and KC-SWCD Lake Specialist Nate Sylvester toured the lake watershed in September of 2001 in order to field verify agricultural land use in the watershed.

3. During the summer and fall of 2001, MACD project personnel - particularly Webber Pond coordinator Jodi Michaud Federle and Forrest Bell - paid numerous visits to the Vassalboro town office and to the Kennebec County SWCD office in order to compile necessary watershed inventory information.

4. On February 28, 2002, a locally-lead Watershed Conservation meeting was hosted by the Kennebec County SWCD at the China Town Office. The meeting was attended by approximately 12 people, including residents of the Webber, Threemile and Three-cornered Pond watersheds. Lake TMDL studies were explained and discussed.

5. A follow-up Watershed Conservation meeting was held on March 28, 2002, hosted by the KC-SWCD at the Vassalboro Town Office. This meeting was attended by 14 people, including residents of the Webber, Threemile and Threecornered Pond watersheds. Water quality information used in creating the TMDL report was supplied to watershed residents.

6. The China Region Lakes Alliance's 2002 spring newsletter featured an article about the TMDL studies for Webber, Threemile and Threecornered ponds.

7. MACD project personnel Jodi Michaud Federle and Forrest Bell met with the owner of the local golf course to discuss the TMDL study and to assess on-site BMPs.

8. A TMDL presentation was made at the Webber Pond Association annual meeting on August 7, 2002, to about 25 shoreline residents. The public review and comment period was also discussed.

Preliminary Stakeholder Review

A preliminary stakeholder review draft Webber Pond TMDL report was submitted to 13 individuals who received electronic or hard copy versions of the report on November 22, 2002, and were

requested to comment by the end of the day on December 6, 2002 (two-week review period). The following summarized comments were provided:

Reb Manthey, Executive Director of the CRLA – provided written comments about how to enhance the overall readability of the report for the layperson.

Morten Moesswilde, Maine Forest Service – commented about liking how the forestry information is distinguished from agriculture and provided more detailed contact information regarding assistance with forestry management.

Frank Richards, Webber Pond Association, President – provided written comments regarding how to enhance the readability of the report; requested more specific information about the drawdown and in-lake remedial options.

Jenna Richardson, CRLA – asked questions regarding phosphorus loading, 'natural background' levels and water quality monitoring.

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